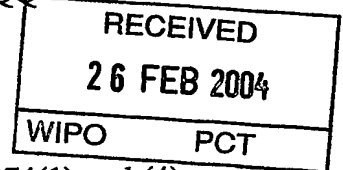




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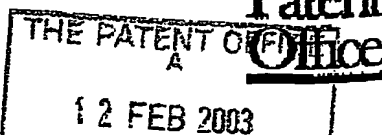
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12FEB03 E784240-1 002776  
P01/3500 0200-030319.2

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(See the notes on the back of this form. You can also get an explanatory leaflet from the Patent Office to help you fill in this form)

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1. Your reference QIP/P3342

2. Patent application number  
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0303119.2

3. Full name, address and postcode of the or of each applicant (underline all surnames)

QINETIQ LIMITED

Registered Office 85 Buckingham Gate  
London SW1E 6PD  
United Kingdom

Patents ADP number (if you know it)

If the applicant is a corporate body, give the country/state of its incorporation

GB

8183857001

4. Title of the invention

Vehicle Arresting Device

5. Name of your agent (if you have one)

Robert William Obee

"Address for service" in the United Kingdom to which all correspondence should be sent (including the postcode)

QINETIQ LIMITED  
IP Formalities  
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Ively Road  
Farnborough  
Hants GU14 0LX United Kingdom

8183873001

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6. If you are declaring priority from one or more earlier patent applications, give the country and the date of filing of the or of each of these earlier applications and (if you know it) the or each application number

Country

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7. If this application is divided or otherwise derived from an earlier UK application, give the number and the filing date of the earlier application

Number or earlier application

Date of filing  
(day / month / year)

8. Is a statement of inventorship and of right to grant of a patent required in support of this request? (Answer 'Yes' if:

- a) any applicant named in part 3 is not an inventor, or
- b) there is an inventor who is not named as an applicant, or
- c) any named applicant is a corporate body. See note (d))

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**Patents Form 1/77**

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Description 5

Claim(s)

Abstract *DM*

Drawing(s) 7 *only*

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Priority documents

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Statement of inventorship and right to grant of a patent (*Patents Form 7/77*)

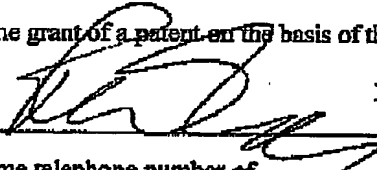
Request for preliminary examination and search (*Patents Form 9/77*)

Request for substantive examination (*Patents Form 10/77*)

Any other documents  
(*please specify*)

11. I / We request the grant of a patent on the basis of this application.

Signature



R. W. Obee, Agent for the Applicant

Date 12.02.2003

12. Name and daytime telephone number of person to contact in the United Kingdom

Mrs Linda Bruckshaw 01252 392722

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**Patents Form 1/77**

**Vehicle Arresting Device**

The present invention relates to vehicle arresting devices, such as may be deployed by law enforcement agencies to safely stop the progress of a suspect vehicle for  
5 example if stolen or engaged in other criminal activity.

Vehicle pursuit is one of the most common high-risk areas of law enforcement and many people are killed each year as a result of high speed chases. An alternative method for stopping, or attempting to stop, a fleeing vehicle which is quite widely  
10 practised is to deploy on the roadway ahead of the vehicle a device intended to puncture its tyres. A common form of this type of device comprises a lightweight plastics latticework which is laid across the road and carries a number of tubular spikes. When the target vehicle passes over the device some of the spikes  
15 penetrate its tyres and are carried along with the vehicle enabling deflation of the respective tyre(s) through their hollow construction. While tyre deflation significantly retards a vehicle and makes it difficult to control, devices of this kind do not necessarily result in the vehicle being stopped, or may do so only after the suspect has been able to continue driving for a considerable distance further.

20 Another form of device intended for more positive arresting of the progress of a vehicle is proposed in US 6220781. This device comprises a panel of lightweight material, such as silk, to be laid on the roadway and having a tactile surface at its leading edge formed from barbed pins and/or adhesive blisters. A split seam  
25 extends through the panel from the centre of its leading edge to approximately three-quarters of its length (in the fore and aft direction) and a reinforcement sash of Kevlar<sup>®</sup> or similar material is affixed to the panel and extends in a partial loop around the split. The intention is that when a vehicle encounters this device its leading edge  
30 will adhere to the front wheels so that the panel will wrap around the wheels until, when the limit of the split seam is reached, the reinforcement sash is drawn tight under the vehicle thereby preventing further rotation of the wheels. It is essential to this operation, however, that the vehicle encounters the device with its front wheels  
35 disposed either side of the split seam, and important that they run directly over the relatively narrow reinforcement sash in order to ensure that the latter becomes wrapped around the wheels. In other words the operation is sensitive to the correct lateral positioning of the vehicle relative to the device, and it is likely to be successful only where the vehicle can be constrained to pass through a relatively narrow gap where the device is deployed.

The device in accordance with the present invention to be more particularly described herein is in some respects similar in operation to the device of US6220781. However in place of a panel with a split seam and reinforcing sash its principal component is a net provided with spikes along its leading edge and capable of certain transverse elongation between any two points across its width at which it may be encountered by the wheels of a vehicle. The individual spikes are preferably tipped with generally pyramidal barbs.

These and other features of a vehicle arresting device according to the invention will now be more particularly described, by way of example, with reference to the accompanying drawings of a preferred embodiment thereof and in which:

Figure 1 is a plan view of a preferred form of vehicle arresting device in its deployed configuration;

Figures 2 and 3 are respectively a side elevation and an underneath plan view of a typical spike assembly incorporated in the device of Figure 1, to an enlarged scale;

Figures 4 and 5 are respectively a side elevation and a top plan view of the spike in the assembly of Figures 2 and 3, to a further enlarged scale, and Figure 6 is a partial section on the line VI-VI of Figure 5;

Figure 7 is a view to an enlarged scale of the region of the device indicated at 'X' in Figure 1;

Figure 8 is a section on the line VIII-VIII of Figure 7, to a further enlarged scale;

Figure 9 is a view to an enlarged scale of the region of the device indicated at 'Y' in Figure 1, from beneath; and

Figures 10(a) and 10(b) illustrate schematically the configuration of the net incorporated in the device of Figure 1 in its natural woven condition and in the condition in which it is assembled respectively.

With reference to Figure 1 there is shown a plan view of a vehicle arresting device in accordance with the invention in its deployed configuration, that is to say laid flat

upon the ground with the intention of arresting a vehicle travelling in the direction of arrow A. The device comprises a net 1 of rectangular planform (the mesh of which is illustrated only schematically in Figure 1 but is more accurately depicted in Figures 7 and 9). The net 1 is preferably woven from high breaking strain braided polyethylene and is similar in this respect to commercial fishing netting. In the illustrated condition the overall shape of the net is maintained by strips of flexible material 2, 3, 4, 5, 6 and 7 attached respectively at its leading and trailing edges (in the sense of its orientation to oncoming traffic), side edges and transversely at two intermediate locations. At the leading edge there are two transverse rows of upwardly-directed hardened steel spikes 8, the form of which will be more particularly described with reference to Figures 2 to 6. Tapes 9 are also attached to the strips 2, 3 and 4 at the leading, trailing and one side edge in order to facilitate the manual folding and deployment of the assembled device.

With reference to Figures 2 and 3 each spike 8 is part of an assembly 10 comprising also a perforated steel base 11 welded to the respective spike. The relatively wide base 11 helps to ensure that the spike remains upright when the device is laid on the ground, and is perforated to minimise the weight of the assembly. As shown in Figures 4 to 6, each spike 8 is machined to define a shaft 12 tipped with a sharply pointed, generally pyramidal barb 13. More particularly the barb 13 is polygonal in planform, being machined from a solid cone to provide three major flat faces 13A between three minor frustoconical faces 13B with a common vertex 13C, and is undercut at its base as indicated at 13D in Figure 6. This form of barb with flats 13A machined into a cone has been found to require less force to penetrate conventional tyre rubber than the equivalent plain cone.

Figures 7 and 8 show the relationship of the net 1, spike assemblies 10 and leading edge strip 2. In each row there is a spike 8 located at each alternate knot across the width of the net 1, with the two rows laterally offset from each other by one knot. The spikes are held on the strip 2 at the correct spacing by multiple hook and loop contact fastener material such as that known under the registered trade mark Velcro. Lengths of Velcro® hook material 14 (Figure 8) are sewn to the leading edge strip 2 where the two rows of spikes are required and the spike assemblies 10 are attached by respective pads of Velcro® loop material 15 passing over the spike assembly bases 11 and into contact with the hook material 14, the pads 15 being apertured to pass the spikes 8. Holes 16 and 17 are shown cut through the material of the strip 2 and (in the case of holes 17) through the associated Velcro® fasteners in Figures 1

and 7 to reduce both the weight of the overall assembly and any aerodynamic forces due to wind acting on the leading edge of the device when deployed.

Having attached the spike assemblies 10 to the leading edge strip 2 they are assembled with the net 1 by thrusting the barb 13 of each spike through the respective knot of the net and passing the knot down to engage frictionally around its shaft 12, as shown for the knot 1A in Figure 8. A plastics tube 18 is passed over the exposed length of each spike 8 to resist lifting of the net along the shaft 12 and to prevent the barb 13 snagging on the net when it is folded for storage and transportation.

Figure 9 shows the relationship of the intermediate strip 6, net 1 and side strip 4, the equivalent applying to the opposite side strip 5 and for the trailing edge strip 3 and other intermediate strip 7. The strip 6 comprises a length of webbing which is threaded through the width of the net 1 as illustrated. At each side edge the respective strip 4 or 5 is folded over the net 1 and over the ends of the strips 2 (see also Figure 7), 3, 6 and 7, and glued thereto. To further anchor the side strips 4 and 5 to the ends of the strips 3, 6 and 7 rivets 19 are applied, passing through the material of the respective strips and a local loop of the net. At the leading edge, the side strips 4 and 5 are apertured to pass the outermost spikes 8A, 8B in each row, as shown for the strip 5 in Figure 7.

The illustrated device is designed to be man-portable and is normally kept folded in an appropriate backpack, from which it can rapidly be unfolded and deployed across a roadway when a target vehicle is to be arrested.

In use, when a vehicle encounters the deployed device from the direction of arrow A in Figure 1, its front tyres will run over a number of adjacent spikes 8 in each of the rows. As a respective spike is encountered the surrounding tube 18 (Figure 8) is crushed down by the tyre, allowing the spike to penetrate the tyre. The barb 13 is shaped to facilitate entry of the spike into the tyre, and its undercut 13D (Figure 6) is designed to catch on the conventional steel braiding within a tyre carcass to resist removal. The net 1 therefore becomes attached to the wheels of the vehicle at two locations across its width, being trapped between the bases of the respective spike assemblies and the tyres in which the spikes are embedded. Continued movement of the vehicle therefore causes the net to wrap around the front wheels and it is pulled tight under the vehicle until the tension in the net prevents further rotation of

the wheels, thereby bringing the vehicle to a stop. In practice this occurs in a similar distance to an emergency stop as if the vehicle's brakes had been applied.

It is important to the successful operation of the device that the net 1 has sufficient lateral stretch to absorb the loads that are imposed on it as it pulls tight to arrest a vehicle, and to allow the net to become fully wrapped around the front wheels before the tension builds up to a level at which there might otherwise be a risk of the spikes 8 being pulled from the tyres. In this respect it will be noted from Figures 7 and 9 that in the initial deployed condition of the device the loops of the net are in a diamond shape with the longer dimension in the fore and aft direction. It is therefore capable of significant lateral elongation before the loops are pulled to a condition in which their longer dimension is in the transverse direction and the net begins to tighten. More particularly, the "natural" form of the loops in which the net is originally woven is rectangular with the longer dimension in the transverse direction, as schematically depicted in Figure 10(a) (where the size of the loops is greatly exaggerated for ease of illustration). In the course of assembly of the device, before the strips 2 to 7 are attached, the net is pulled out of the "natural" shape of Figure 10(a) and held in a jig in the less elongate aspect ratio schematically depicted in Figure 10(b) in which it is subsequently retained by the attachment of the strips 2 to 7. Note, however, that the presence of these strips does not prevent the portion of the net between the wheels of a vehicle elongating laterally in use of the device because it is not constrained in that sense by positive attachment to the strips 6, 7 and 3 intermediate its attachment to the side strips 4 and 5, and at the leading edge its attachment to strip 2 is by means of the Velcro® pads 15 over the bases of the spikes 8 which can pull off from the Velcro® material 14 as the net stretches.

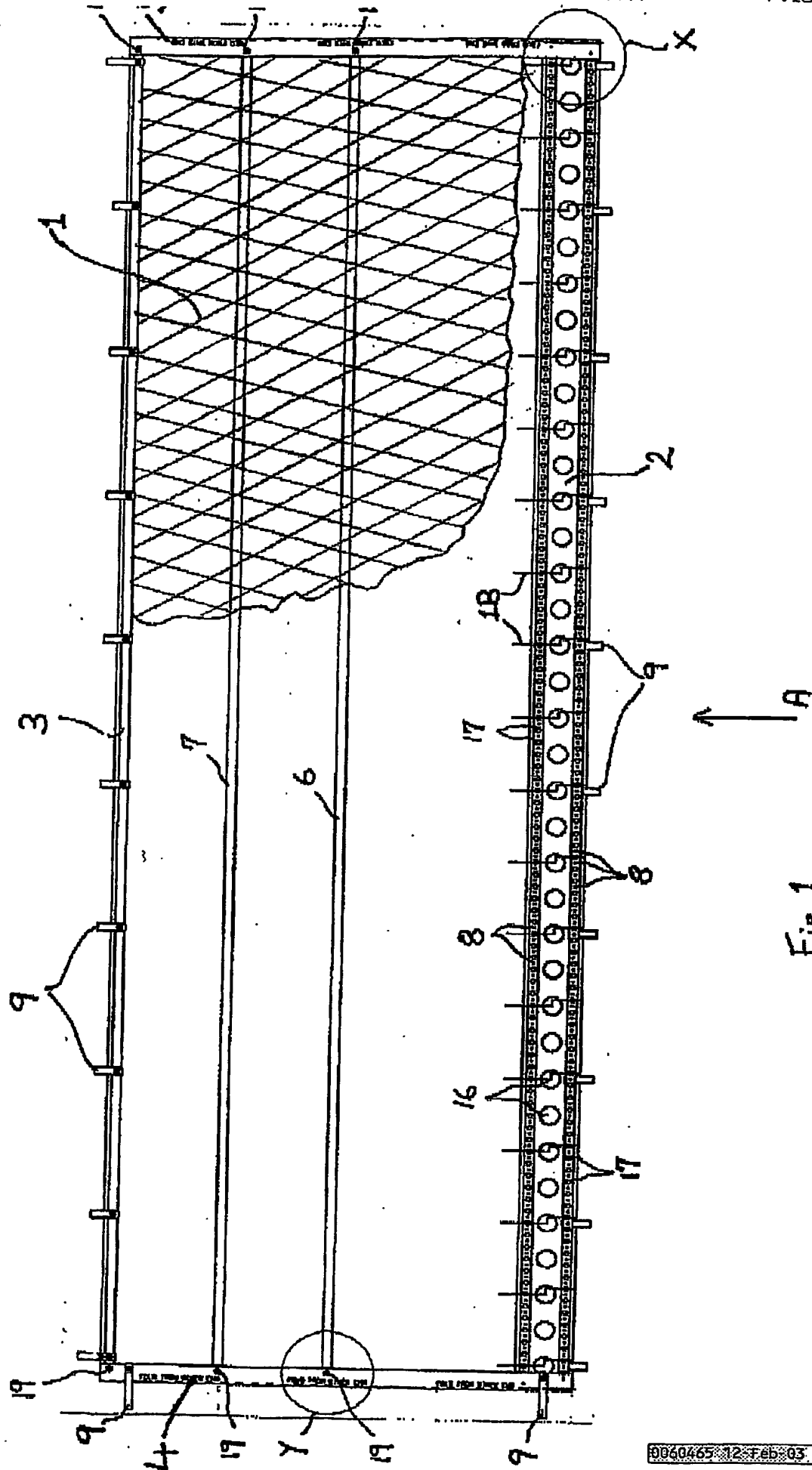
It should also be noted that the device can operate to arrest a vehicle as described above so long as both front tyres run over its leading edge, irrespective of the position across the width of the device where this actually occurs.

30

In order to enhance the initial attachment of the net 1 to the vehicle's tyres its leading edge may be formed with a series of short longitudinal cuts spaced across its width, as schematically indicated at 1B in Figure 1. By this means only the respective section of the net between the adjacent cuts has to be lifted by the tyre during the initial part of its rotation after contacting the spikes 8, which further minimises the risk of the spikes being pulled from the tyre.

35





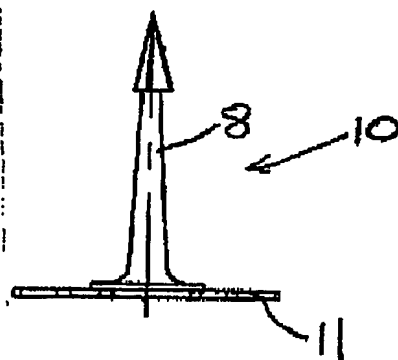


Fig. 2

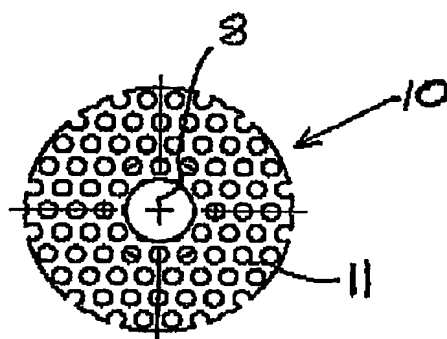


Fig. 3

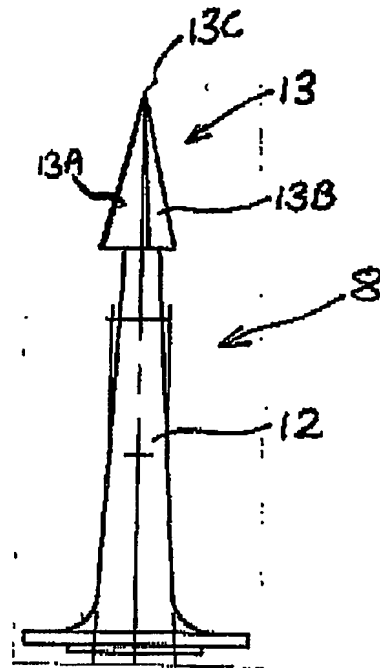


Fig. 4

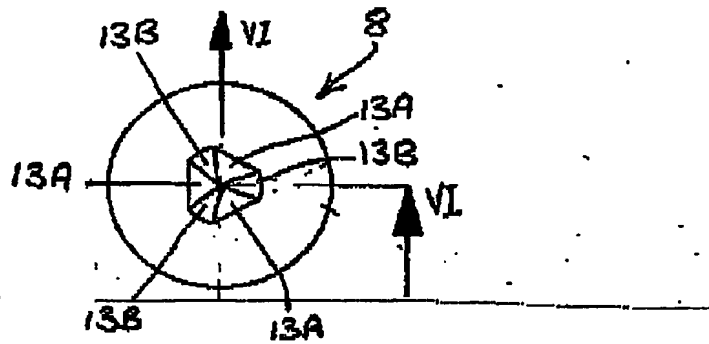


Fig. 5

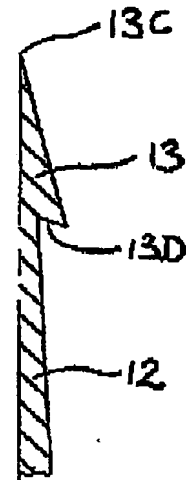


Fig. 6

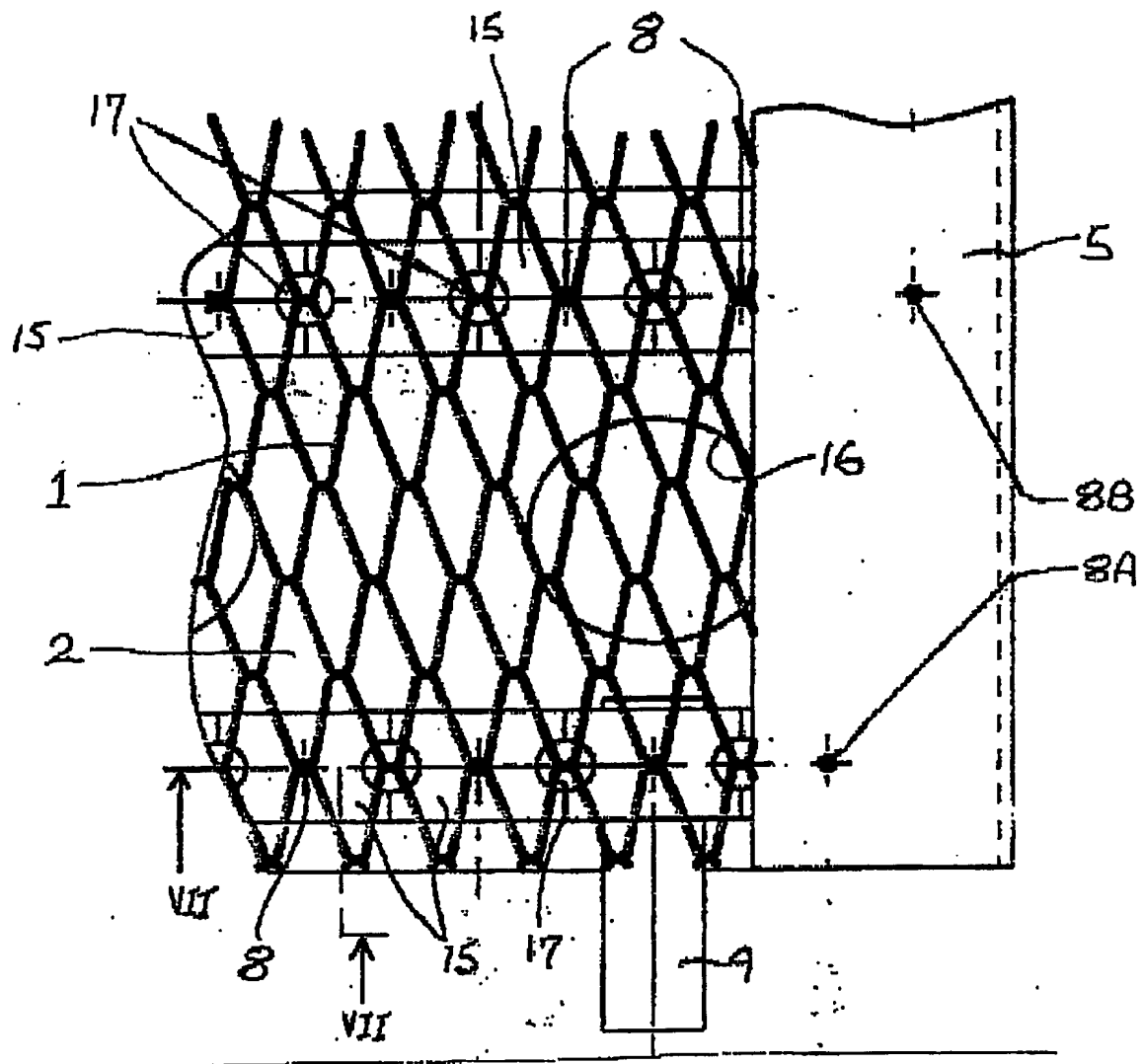


Fig. 7

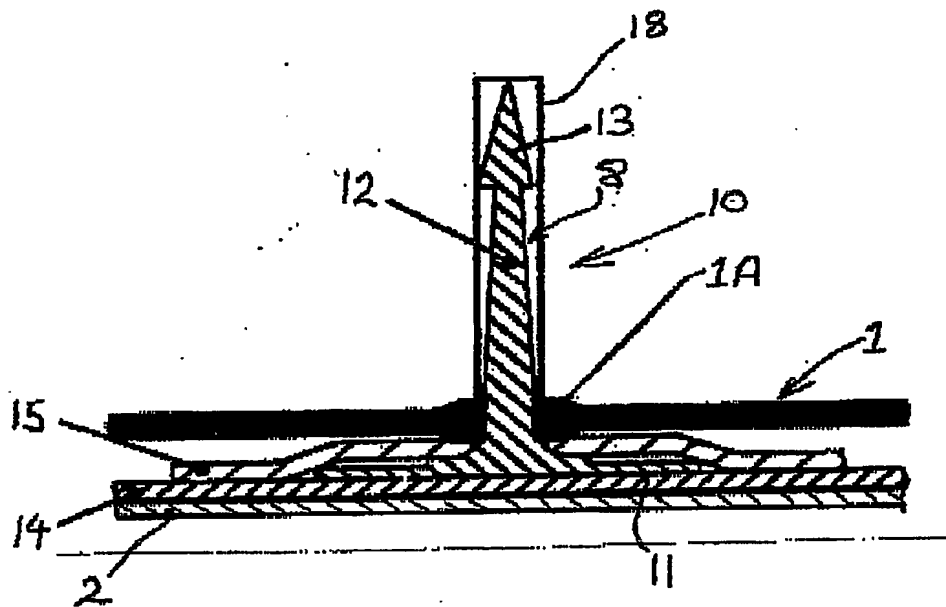


Fig. 8

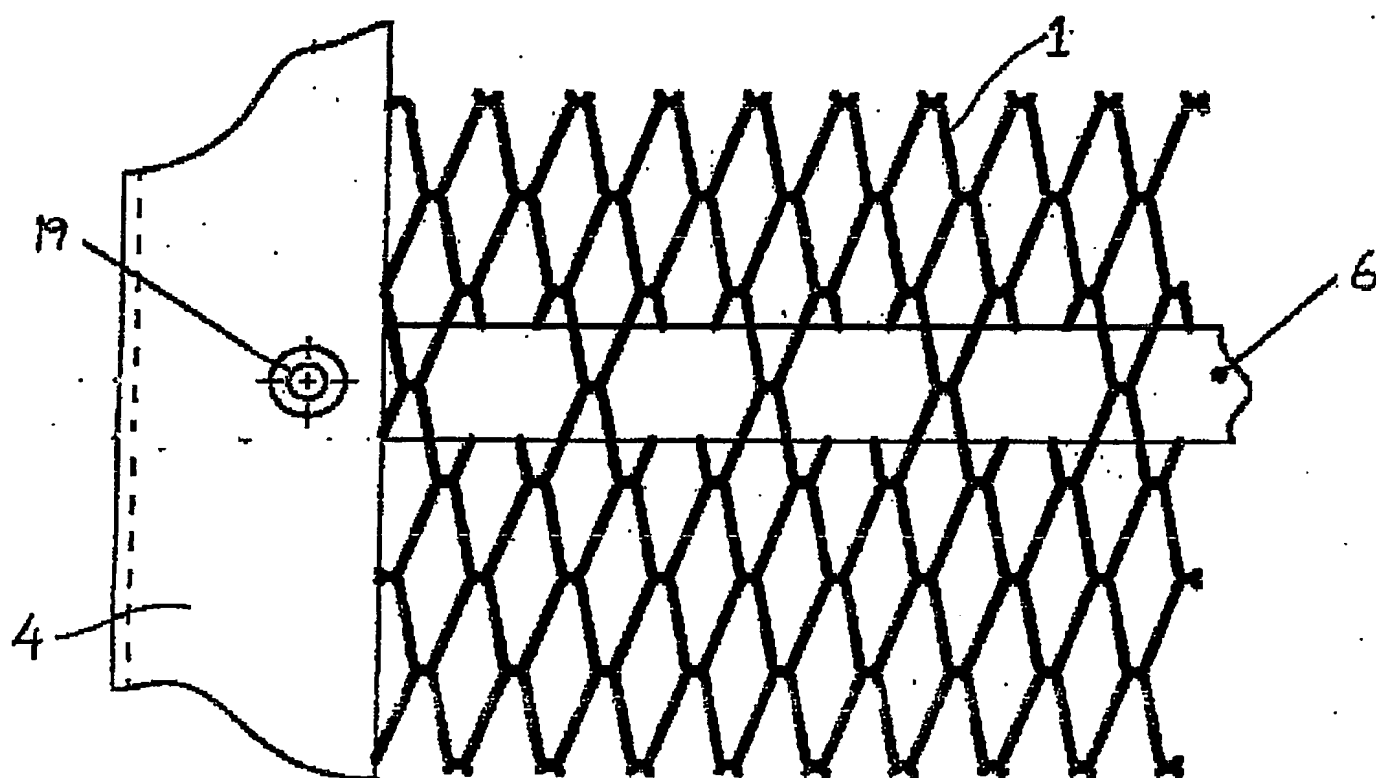
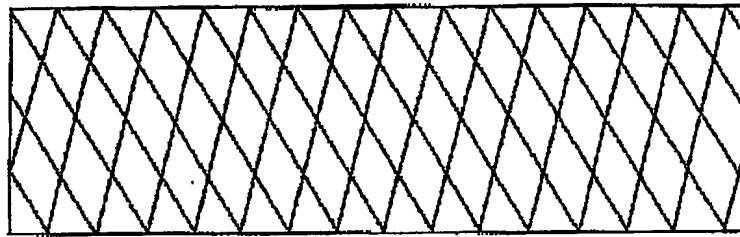


Fig. 9



(a)



(b)

Fig 10

PCT Application  
**PCT/GB2004/000048**





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